PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Title: **EDIBLE PROTEIN MATRIX AND METHOD FOR MAKING THE SAME**

Applicant/Appellant: David W. Galloway	Appln. No.: 10/811,452
	Filing Date: 26 March 2004
	Examiner: Sarah Kuhns
Atty. Docket: 1821-001-03	Group: 1761

CERTIFICATE OF MAILING

I hereby certify that this communication, and any document being attached hereto, is being deposited with the U.S. Postal Service with sufficient postage as First Class Mail addressed to: Board of Patent Appeals and Interference, US Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450

on this 17th day of March, 2006.

Stephen M. Evans

TRANSMITTAL LETTER

TO THE COMMISSIONER FOR PATENTS

Transmitted herewith are the following documents for filing in the above application appeal:

1) Appeal Brief (original only). Please charge the $250 Appeal Brief Fee to Deposit Account No. 07-1897. (a duplicate copy of this transmittal letter is enclosed)

2) return postcard

Respectfully submitted,

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TO THE BOARD OF PATENT APPEALS AND INTERFERENCES:

Brief of Appellant

Real Party in Interest: David W. Galloway, an individual and resident of the State of Washington, is the sole inventor and owner of the subject matter disclosed and claimed in the above-referenced United States utility patent application ("the '452 application").

Related Appeals and Interferences: The applicant/inventor and the undersigned have no knowledge of any other prior or pending appeal, interference or judicial proceeding that may be related to, directly affected by or have a bearing on the Board of Patent Appeals and Interference's ("BPAI") decision in the pending appeal.

Present Status of Claims, Prosecution History and After Final Amendments: This is an appeal from the final rejection by the Examiner on 12 July 2005 of pending claims 1-10 and 20-22, and 24-30 on the basis that the pending claims were obvious under 35 USC

§103(a).[1] After an interview with the Examiner, the details of which will be described below, applicant submitted an amendment after final, which was ultimately entered by the Examiner. No new claims were added and no claims were cancelled by way of this amendment.

Of the 23 claims originally submitted with the instant application, applicant canceled claims 11-19 in response to a restriction requirement, and added new claims 24-27 drawn to the elected invention. In her first substantive communication of 14 March 2005, the Examiner rejected claims 1, 2, and 4-7 on the basis of anticipation and claims 3, 8-10, and 20-27 on the basis of obviousness.[2] Applicant amended the claims to distinguish the claimed invention in certain respects, and to clarify certain terms in other respects. In addition, applicant added new claims 28-30 and cancelled claim 23.

In response to applicant's amendment and remarks, the Examiner issued a second and final office action. In that second substantive communication, the Examiner changed her §102(b) rejections to §103(a) rejections with respect to claims 1, 2, and 4-7, and maintained her §103(a) rejections with respect to claims 3, 8-10, and 20-27. She further rejected §103(a) newly added claims 28-30. Because several rejections appeared to be based upon insufficient understanding of the invention by the Examiner, applicant believed that an interview with the Examiner would resolve most, if not all, differences of opinion between the Examiner and the applicant. Moreover, applicant believed that a collaborative approach to the proper selection of key terminology would assist the Examiner in understanding applicant's position that the claimed invention patentably defined over the prior art.

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[1] Applicant had cancelled claim 23 prior to issuance of the referenced Final Office Action; the Examiner failed to reflect this cancellation in the Final Office Action. Nevertheless, in at least one communication since then the Examiner had confirmed this fact, however, both the Final Office Action and the last Advisory Action reference claim 23 as pending. Consequently, appellant is not appealing this claim. Additionally, claim 7 stood rejected under 35 USC §112 ¶2, however, applicant presumes that the rejection was withdrawn upon consideration by the Examiner of a reference supporting applicant's position.

[2] The Examiner also rejected claim 7 under 35 USC §112 ¶2, but this rejection is not germane to the issues herein.

After an interview with the Examiner and her supervisor, applicant believed that resolution and clarity had been achieved, and applicant filed his response to the final office action on 7 October 2005. Due to a word processing error, the response failed to show the tracked changes to amended claims 1 and 2, and the Examiner dutifully issued a Notice of Non-Compliant Amendment. Within four days of applicant's receipt of the Notice of Non-Compliant Amendment, applicant submitted a response thereto wherein the error was remedied. Thereafter, the Examiner issued a second Advisory Action, declining to enter applicant's amendments on the basis that "the newly added limitation that the intermediary film be generally uncured and used as a precursor to a final manipulation and curing process requires further search and consideration."

After reviewing the prosecution history of the application, it became quite clear to applicant (and later to the Examiner) that originally submitted claim 20, which was examined and rejected, consisted of nearly identical language and limitations, and therefore the Examiner's refusal to enter the amendment was issued in error. In the originally submitted claim 20, applicant used the term "uncured intermediary film", which was later amended to use the term "preset" in response to the agreements reached during the interview. After a telephone conversation with the Examiner wherein applicant expressed his position, the Examiner asked applicant filed a Request for Withdrawal of the Advisory Action and Entry of Applicant's Amendments of 31 October 2006. Apparently conceding applicant's position, the Examiner entered applicant's amendments and issued the last Advisory Action shortly thereafter. In that last Advisory Action, the Examiner maintained her previous rationale for rejecting the pending claims, precipitating applicant's appeal. A copy of all claims upon which this appeal is based and for which amendments have been entered appears in **Appendix "A"** attached hereto.

Summary of the Claimed Subject Matter[3]

Applicant's claimed invention relates to an edible protein film composition that can be formed into a plurality of shapes through the "joining" and/or "bonding" of

[3] All citations herein are made to the text and pagination appearing in WO 03/034829 (PCT/US01/30184).

selected portions of the film(s) during the manufacturing process. The composition of the film is primarily of protein, and a preferred shape is a pocket for receiving other foodstuffs. *See*, Abstract. The invention is particularly directed to both an intermediary film (for making a final product) as well as a final, cured product created from the film. Independent claim 1 is directed to the intermediary film while independent claim 20 is directed to a two-part configurable film. In both instances, the resulting final product is not an element of the base, independent claims. Page 1, lines 23-29; page 2, lines 8-17. In particular, the intermediary film of claim 1 as amended comprises a generally uncured intermediary film having greater than 50% processed protein by weight and a non-laminated thickness of between about 1mm to 4mm to be used as a precursor to a final manipulation and curing process. The two part configurable film of claim 20 comprises a first preset film having greater than 50% muscle protein by weight, and a second preset film having greater than 50% muscle protein by weight, wherein the first film and the second film are joined to each other at pre-established locations prior to and during subsequent curing to form bonds there at.

Grounds of Rejection

1. The Examiner rejected claims 1, 2, 4-7 under 35 USC § 103(a) over Devro Limited, WO 92/01394 ("Devro") in combination with Kojima et al., JP 56137871 A ("Kojima"). Devro is represented as disclosing an edible protein matrix for use in creating edible compositions and comprising an intermediary film having greater than 50% processed protein by weight (page 6, lines 35-36 and claim 9). Kojima is relied upon to supply the missing thickness element, e.g., a film thickness of between 0.5-2 mm (abstract). With respect to the remaining rejected claims, Devro is represented as disclosing each additional claim element.

2. The Examiner rejected claim 3 under 35 USC § 103(a) over Devro in combination with Kojima and further in combination with Fetzer et al., US 4133901("Fetzer"). Fetzer is represented as disclosing a moisture content within the parameters of claim 3.

3. The Examiner rejected claim 10 under 35 USC § 103(a) over Devro in combination with Kojima and further in combination with Nakajima, US 4670276 ("Nakajima"). Nakajima is represented as disclosing the use of surimi as the processed protein.

4. The Examiner rejected claims 8, 9, 20-30 under 35 USC § 103(a) over Devro in combination with Kojima and further in combination with Food Packaging Technology ("FPT"). FPT is represented as disclosing the common practice of making various pouches from one or two intermediary preset films.

ARGUMENT IN SUPPORT OF PATENTABILITY

1. The rejections of claims 1, 2, 4-7 under 35 USC § 103(a) over Devro in combination with Kojima are unsupported and therefore must be withdrawn because a skilled practitioner would not be motivated to seek Kojima even with the benefit of hindsight.

The Examiner's rationale for maintaining the rejections suffer a fatal infirmity: only through the reliance on improper hindsight can the combination be sustained. Devro discloses a collagen protein, ultra-thin film moisture barrier. The publication states that "...the films of the invention are generally undetectable (whether visually or organoleptically) in the cooked products." Page 5, at lines 3-6. Thus, while there is no disclosure concerning the thickness of the Devro films, one can infer that they are sufficiently thin so as to be generally undetectable by sight, touch or taste. This inference is further bolstered by the fact that a hydrophobic coating applied to the film is only 0.0005" thick (5 ten thousandths of an inch). Page 10, at lines 35-36. Thus, Devro not only discloses such a delicate moisture barrier film, but also teaches the importance of such covert films.

Apparently conceding that Devro lacks disclosure concerning comparatively thick films, the Examiner relies upon Kojima to establish the presence in the prior art of thicker films, *i.e.*, films in the range claimed applicant. It is applicant's position, however, that the proposed combination of Devro and Kojima is improper regardless of

Kojima's disclosure or any other prior art reference that discloses any moisture barrier film having visual or organoleptical properties. As established above, the intended purpose of Devro's moisture barrier film is to be transparent to the consumer of the food product in which it resides. For this reason, Devro relies upon a collagen protein mixture (preferably from cattle skin or intestines) as opposed to that comprised of muscle tissue, since it is not feasible to obtain the required very thin film from a non-collagen protein mixture. In other words, the objective in Devro is to create a very thin film.

In direct opposition to the teachings and objectives of Devro, the Examiner contends that a skilled practitioner in the edible moisture barrier arts and knowledgeable about Devro would be motivated to seek alternative film compositions that a) could not form the required " generally undetectable" thin film because of the requirement that the films be between 1-4 mm in thickness (claim 1), or b) are created from muscle protein (claim 2), which is incapable of forming the thin films, which are the objective of Devro as stated above and therein.[4] Stated alternatively, why would a skilled practitioner seeking to create a thin moisture barrier film that is imperceptible to a consumer be motivated to seek alternative film compositions and properties that can only form highly perceptible films, thus defeating the very objectives espoused in Devro? Furthermore, why would such a practitioner wish to create comparatively thick films in the first place? Devro's film is a covert component in a food product, while applicant's film is the product itself. The inescapable conclusion is that a skilled practitioner would not be inclined to seek such comparatively thick films nor be inclined to increase the perceptibility of moisture barrier films. Thus, the combination advanced by the Examiner to reject the invention of claim 1 is improper and must be withdrawn.

With respect to claim 7, applicant has established that the units of measurement regarding the gel strength of the films is proper. *See* applicant's response to the 12 July 2005 office action and **Appendix "B"** herein. Insofar as the Examiner has failed to

establish any prior art meeting this additional limitation, applicant submits that any art-based rejection is unsupported, and that any non-art-based rejection is moot.

2. The rejection of claim 3 under 35 USC § 103(a) over Devro in combination with Kojima and further in combination with Fetzer is unsupported and should be withdrawn because the base combination of Devro and Kojima is improper.

Fetzer is represented as disclosing a moisture content within the parameters of claim 3. Regardless of whether Fetzer is applicable, the underlying Devro-Kojima combination is improper for the reasons expressed above, and therefore the combination advanced by the Examiner with respect to claim 3 must fail.

3. The rejection of claim 10 under 35 USC § 103(a) over Devro in combination with Kojima and further in combination with Nakajima is unsupported and should be withdrawn because the base combination of Devro and Kojima is improper.

Nakajima is represented as disclosing the use of surimi as the processed protein. Regardless of whether Nakajima is applicable, the underlying Devro-Kojima combination is improper for the reasons expressed above, and therefore the combination advanced by the Examiner with respect to claim 10 must fail.[5] Moreover, skilled practitioners appreciate that surimi primarily comprises muscle protein, which for the reasons expressed above in section 1 above, cannot be processed into a thin moisture barrier film of the quality expressed by Devro.

4. The rejections of claims 8, 9, 20-30 under 35 USC § 103(a) over Devro in combination with Kojima and further in combination with FPT because the claimed combination involves joining preset films and subjecting them to a subsequent cure while the relied-upon combination fails to disclose or suggest such a final product.

FPT is represented as disclosing the common practice of making various pouches from one or two intermediary preset films. Claim 20 differs from claim 1 in that

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[4] The inventor had made this assertion earlier in the prosecution of this application, and the Examiner has not rebutted it. If the BPAI believes that a declaration or other supporting evidence is needed, applicant requests leave to provide this Board the same.

it is directed to describing the nature of the joinder between two films comprising processed protein. As elucidated during applicant's interview with the Examiner, usage of the following terms and phrases, whose meanings are present in the specification at page 5, lines 24-29 and page 5-6, lines 30-3, is neither incidental nor accidental: "preset film"; "joined"; "prior to and during subsequent curing". Through experimentation, it has been found that creation of a cavity or pocket from the intermediary films is optimized when an initial form is established, beginning with preset films (as that term is defined in the specification). Once the films are set, and thus take on the form imparted by, for example, a mold, selected portions of each film can be joined to one another prior to and during a subsequent curing action to form the desired bonds. If the intermediary sheets were cured prior to the subsequent joinder, a bond could not be formed absent the use of some "glue" such as molten cheese (as advanced by Nakajima), which applicant implicitly rejects.

In view of the foregoing, applicant has been unable to identify any prior art reference that discloses or suggests a configurable protein matrix comprising two <u>preset</u> films that are selectively joined to each other, prior to any formal curing, in order to create a direct film-to-film bond during the formal curing process. The invention disclosed by Nakajima relies upon a filler layer to effectuate a bond between two cured sheets of surimi. This is not what is claimed in applicant's claim 20. Moreover, the technology disclosed by Nakajima teaches by omission that a surimi-to-surimi bond is not possible without such a filler layer. The Examiner's attempts to rely upon FPT to establish knowledge in the art concerning bonding of one film to another do not take into consideration the claimed limitations. However, simple heat and compression of an already <u>cured film</u> is not what applicant claims, nor are there any suggestions in this or other references supporting the Examiner's proposition. The fact remains that the bonds between the preset films are carefully created, and the means by which they are created are not disclosed or fairly taught in the prior art.

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[5] Applicant notes that the basis for rejection appears to be linked to claim 1; the dependency of claim 10 was changed to claim 20 by amendment during prosecution and all other rejections of claims based upon

CONCLUSION

After receiving the second office action, it became apparent to applicant that the Examiner may not have appreciated the nature of the claimed invention. During and immediately after the interview, applicant believed that the Examiner understood the gist of the invention: either an intermediary edible protein matrix having a generally thick film sufficient for forming a pocket to receive food stuffs (as opposed to a virtually imperceptible thin film), or such cured films having bonds there between wherein the preset films are joined prior to and during subsequent curing to form bonds thereat. When applicant submitted claim amendments intended to clarify the claims and clearly establish patentability of the same, the Examiner issued an Advisory Action refusing to enter applicant's amendments on the erroneous basis that such amendments would require additional search. When pointed out that the amendments complained of were in fact previously considered in a claim with nearly identical import, the Examiner withdrew her refusal and entered applicant's amendment. However, she maintained her basis for rejecting the claims, much to applicant's dismay.

The fact remains, however, that the claimed invention is neither taught nor suggested by the combination advanced by the Examiner, or the Examiner has failed to supply the motivation of a skilled practitioner knowledgeable of Devro to seek Kojima. On either of these bases, the Examiner's rejections of the pending claims must be reversed and the application passed to issuance if no further impediments remain.

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claim 20 incorporate the FPT publication.

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APPENDIX "A"

CLAIMS UNDER APPEAL, AS AMENDED

The following claims represent what are believed to be the current state of claims after entry of all prior amendments as reflected in applicant's submission of 28 October 2005 and the Examiner's Advisory Action of 3 January 2006:

1. An edible protein matrix for use in creating edible compositions and cavities for receiving removable foodstuffs comprising:

   a generally uncured intermediary film having greater than 50% processed protein by weight and a non-laminated thickness of between about 1mm to 4mm to be used as a precursor to a final manipulation and curing process.

2. The matrix of claim 1 wherein the processed protein is derived from muscle tissue.

3. The matrix of claim 20 wherein the films further comprise water in excess of 25% by weight.

4. The matrix of claim 20 wherein the films further comprise a starch.

5. The matrix of claim 20 wherein the films further comprise an oil.

6. The matrix of claim 20 wherein the films further comprise a surface adjunct for modifying the surface characteristics of the films.

7. The matrix of claim 20 wherein the processed protein of the films has an average gel strength between about 850 and 1000 g/cm, inclusive.

8. The matrix of claim 1 wherein the intermediary film is folded upon itself after presetting, and selected portions thereof bonded to one another to form a cavity to retain objects placed therein after subjecting the cavity to curing.

9. The matrix of claim 1 wherein two intermediary films are opposed to each other after presetting, and selected portions thereof bonded to one another to form a cavity to retain objects placed therein after subjecting the cavity to curing.

10. The matrix of claim 20 wherein the processed protein is surimi.

11. (Canceled)

12. (Canceled)

13. (Canceled)

14. (Canceled)

15. (Canceled)

16. (Canceled)

17. (Canceled)

18. (Canceled)

19. (Canceled)

20. A configurable edible protein matrix comprising:

a first preset film having greater than 50% muscle protein by weight;

a second preset film having greater than 50% muscle protein by weight, and wherein the first film and the second film are joined to each other at pre-established locations prior to and during subsequent curing to form bonds there at.

21. The configurable edible protein matrix of claim 20 wherein the first film and the second film are portions of a single film.

22. The configurable edible protein matrix of claim 20 wherein a portion of the pre-established locations between the first and the second film is not bonded, thereby forming an opening.

23. (Canceled)

24. The configurable edible protein matrix of claim 20 wherein the first and the second films have an outer surface and wherein at least one outer surface comprises a visually perceptible synthetic design.

25. The configurable edible protein matrix of claim 20 wherein the first and the second films have an outer surface and wherein at least one outer surface comprises a tactilely perceptible synthetic design.

26. An edible proteinacious envelope comprising:

    at least one film having greater than 50% processed protein by weight, wherein the at least one film is configured to form an envelope structure for containing foodstuffs and defining an opening through which the foodstuffs may be inserted.

27. The envelope of claim 26, further comprising edible foodstuffs within the envelope.

28. The envelope of claim 20 wherein the first and second films are laid up in respective first and second concave molds during presetting, whereby each film generally adopts surface contours of the respective molds.

29. The envelope of claim 26 wherein exterior surfaces of the envelope comprise at least one of synthetic visual or tactile features.

30. The envelope of claim 26 wherein the foodstuff comprises primarily carbohydrates.

APPENDIX "B" – COPIES OF PRIOR ART CITED IN APPEAL BRIEF

SURIMI AND
MI SEAFOOD

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. DEKKER, INC. NEW YORK • BASEL

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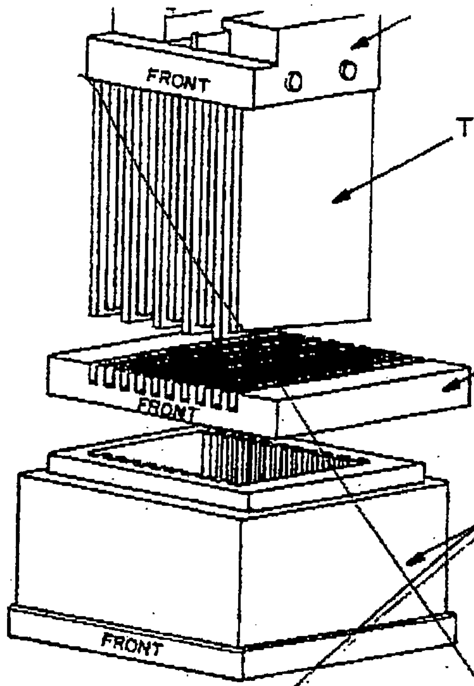


Figure 29 Kramer shear cell. (Courtesy of Food Technology Corp., Rockville, MD.)

and the test sample mass and area are large so the influence of local irregularities is reduced.

A. Punch (Penetration) Test

The punch test, although it is considered an empirical test, is the single most popular gel measurement technique used in the surimi industry for evaluating "gel strength" or stiffness. The punch test imitates the large deformations to failure involved in mastication. Many studies have been reported that correlate puncture methods with the sensory properties of surimi gels. This attribute of the test, coupled with its convenience, has made it popular for the quality control within the surimi industry.

The test was initially developed by Matsumoto and Arai (39) and later modified by Okada (40). The "Okada Gelometer" became the standard instrumental method used in the Japanese surimi industry. In this test, a punch probe of a specific diameter (3.0 mm) and length (25 mm) is used to compress the surface of a gel specimen at a constant deformation rate (10–60 mm/min) until puncture occurs. Many of the modern penetrometers used in industry operate at a fixed 60 mm/min and a 5.0-mm probe is commonly used.

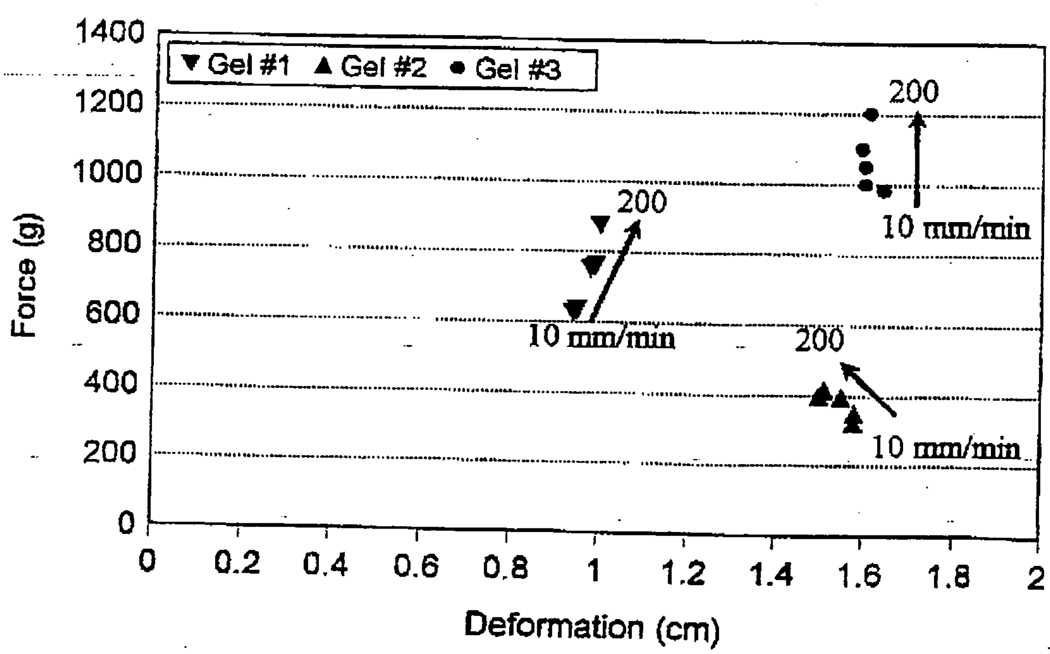
The recorded peak force (F) at break and the depth of penetration are used to describe the gel properties. Often these two values are multiplied together to give the "jelly strength." The jelly strength is the value that is used in the Japanese grading standards. This type of measurement has been frequently used for surimi gel samples and offers a good correlation with attributes such as first-bite hardness.

Although it is very simple and most widely used for objective measurement within the surimi industry, several restrictions are given as follows:

1. For this test to be adequate, either the range of cohesiveness needs to be small enough that it is not considered an important sensory note, or the hardness and cohesiveness of the samples are related in a consistent way so they are not independent. This is often true if protein concentration, species, filler ingredients, and process variables are invariant. The cohesiveness of most surimi seafood varies significantly, depending on surimi quality, and the cohesiveness and hardness vary independently.

2. The punch is usually conducted using a sphere (5–30 mm diameter) driven by a small-diameter shaft at a speed of 10–60 mm/min. A change in test variables can lead to different results for the same sample. For instance, by increasing the downward speed of the probe (Fig. 30) and the size of the probe (Fig. 31), the puncture force for the sample increases.

3. Fracture property measurements of foods are much less reproducible than small deformation parameters, and a coefficient of variation (standard devia-



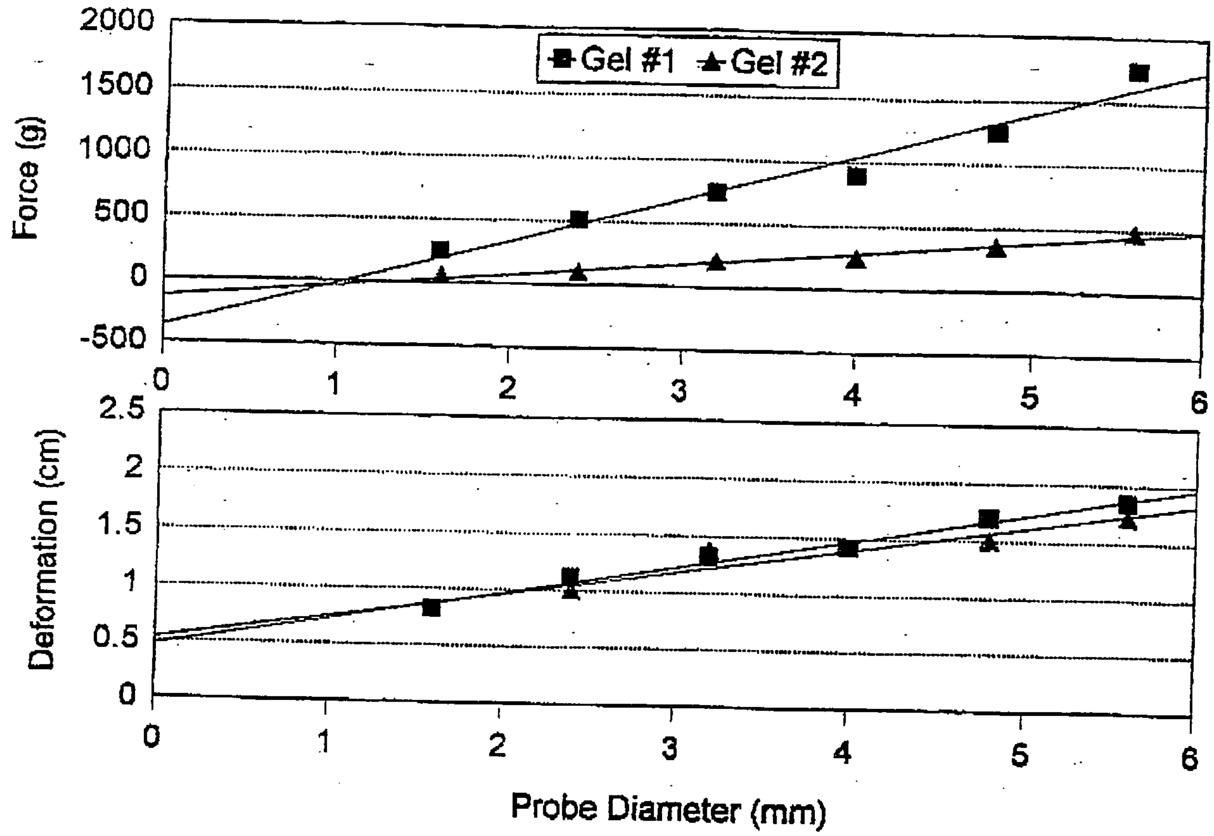


Figure 31 Effects of probe diameter on deformation values of gels. (Adapted from Ref. 5.)

tion of the mean) in the order of 10% is common. For the punch test, which measures gel properties at a point of penetration into the gel, coefficients of variation can be even higher because failure takes place at defects in the sample where the number and extent of such defects may vary from sample to sample. Usually, firmer gels show a higher trend for increased error in the force value. Vacuum chopping may be one option to improve the precision of the test.

4. The use of the term *gel strength*, which is often referred to as jelly strength in Japan, has misrepresented the quality of surimi. Gel strength calculated on the basis of the force multiplied by deformation using a unit of "g.cm" does not provide any significant meanings to the rheological properties of gels. However, it has been arbitrarily (perhaps wrongly) used in the surimi industry as a symbol of surimi quality. As illustrated in Figure 32, it is obvious that five different gels could have the same gel strength (960 g.cm), but the protein quality of the gels is significantly different. When located in a texture map based on force and deformation, they are extremely different. Therefore, if all surimi is equally priced, the purchase of surimi "E" would be ideally the best value because deformation indicates the quality of surimi proteins. Because force values depend on the quantity of proteins (inversely moisture), the purchase of surimi

Gels	Force (g)	Deformation (cm)	Gel Strength (g.cm)
A	960	1	960
B	800	1.2	960
C	600	1.6	960
D	400	2.4	960
E	320	3	960

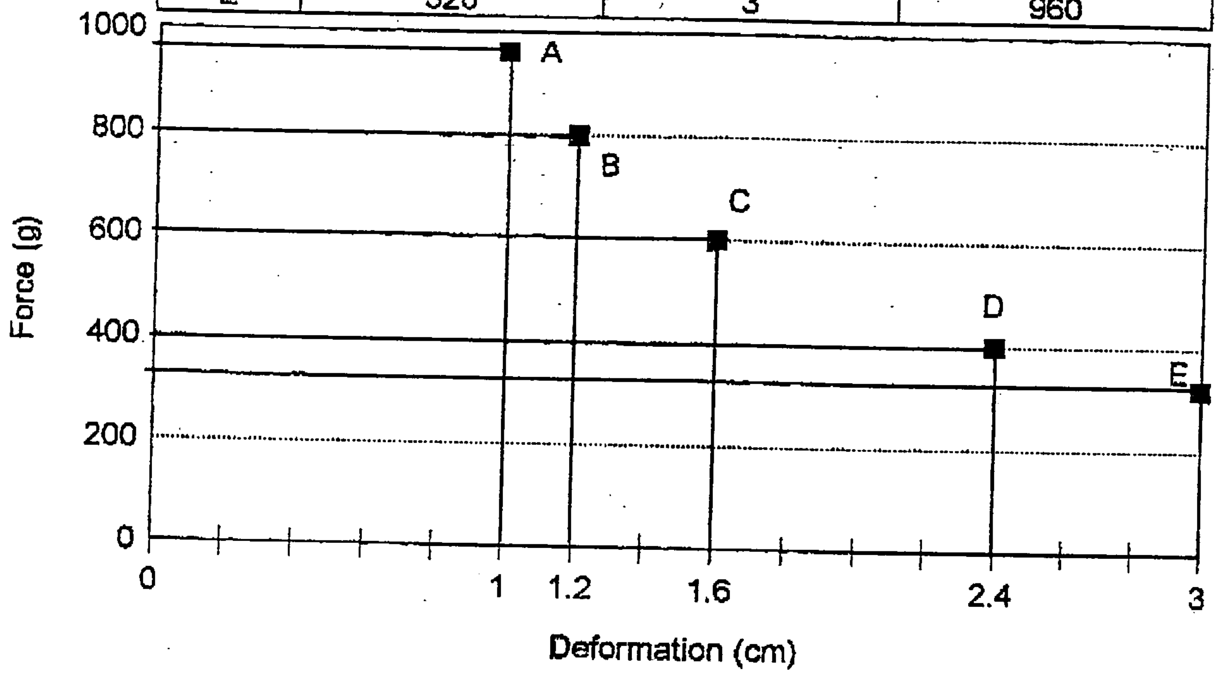


Figure 32 Five different surimi gels with the same gel strength (jelly strength).

"A" would give the least value. Therefore, force and deformation values must be expressed individually, not in the form of gel strength (or jelly strength, g.cm), to indicate the gel functionality of surimi.

B. Texture Profile Analysis

A group at the General Foods Corporation Technical Center pioneered the development of the texture profile analysis (TPA). Their test involved compressing a bite-size piece of food, a cube approximately 1 cm, to 25% of its original height (75% compression) two times in a reciprocating motion, which imitates the action of the human jaw. From the resulting force-time curve, a number of textural parameters that correlate well with the sensory evaluations of those parameters were extracted (1).

The TPA has been widely used for the empirical determination of a number of textural attributes of muscle foods and surimi gels. Texture profile analysis

PCT

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Published

With international search report.

(54) Title: MOISTURE BARRIER FILM

(57) Abstract

A moisture barrier film, which is of particular utility in the manufacture of food products, comprises an edible protein and an edible polysaccharide. The film is rendered at least partly moisture-impermeable by the provision of a coating of an edible hydrophobic material on at least a portion of a surface thereof.

+ DESIGNATIONS OF "SU"

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MOISTURE BARRIER FILM

This invention relates to a moisture barrier film, and more particularly to an edible film which is suitable for use as a moisture barrier in food products.

Films have been used in food preparations for various reasons for centuries. These applications include the protection of raw and cooked foods, the containment of wet foods and flavours, the separation of wet from dry foods, and the preventing of drying. Examples of the use of natural films in food products are sheep/hog stomach for wrapping comminuted meat as in haggis, and the use of intestines for the manufacture of sausages (see Tannahill, R., "Food in History", pub. Stein & Day, NY.). In this century, the evolution of plastics films and plastics laminates has allowed a great diversification in food wrapping for the purposes of protection from gross and microbial contamination, inhibition of oxidation, and containment (see Daniels J.A. *et al* (1985) J. Food Protect. 48, 532; Neilsen, H.J.S. (1983) J. Food Protect. 46, 693; and Jantavat, R. & Dawson, L.E. (1980) Poultry Sci. 59, 1053).

Collagen, a naturally occurring connective tissue protein, has been used for the manufacture of food wrapping films on a commercial basis. Films of this type are disclosed, for example, in US-A-3664844 and US-A-3529530. The benefits of using collagen for the manufacture of food films are that it is a natural product, the chemistry of which is well understood (see Ramachandran, G.N. & Reddi, A.H. (eds.) (1976) "Biochemistry of Collagen", pub. Plenum Press, NY. & London), it can be readily comminuted and converted to a viscous gel or mass and it can be extruded in a number of forms including films (see Chvapil, M. (1979) in "Fibrous Proteins: Scientific, Industrial and Medical Aspects", Vol. 1, pp. 247 *et seq* (D. Parry & L. Creamer, eds.), pub. Academic Press, NY. & London). Collagen films

disclosed an alternative film derived from soya protein, casein, albumin or gelatine with polysaccharides such as gum arabic and starch. Such a film, like conventional collagen films, is moisture-permeable.

Moisture-impermeable films have also been widely used in the food industry. These include, for example, the plastics food wrappings already mentioned above. Much earlier examples include the use by the ancient Chinese of edible wax coatings on fruit to prevent drying during storage and the use of fat wrappings (lardings) in 16th century Britain.

More recently, a non-edible, disposable food wrap made from a laminate of saccharides and vinylon film has become available from Showa Denko K.K. of Japan. This film is said to absorb moisture, thereby limiting moisture migration.

Japanese Patent No. 301387 (Kanebo K.K.) describes a zeolite-based non-edible film with moisture absorbing ability which is claimed to extend shelf-life.

Some attempts have also been made in recent years to produce commercially viable films which are both edible and moisture-impermeable. For example, wax and protein sprays have been used in the bakery industry, but with little success.

The combination of fatty acids and modified cellulose with wax layers has been reported for use as a moisture barrier film (see Kamper, S.L & Fennema, O. (1984) J. Food Sci. 49, 1478 and 1482; and (1985) J. Food Sci. 50, 382; Kester, J.J. & Fennema, O. (1989) J. Food Sci. 54, 1383 and

water which passes across the film per unit area. A suitable technique (and the one used herein) is that described by Kester & Fennema, (1989) J. Food Sci. 54, p.1384, modified in that water vapour pressure in the container is maintained at zero by means of anhydrous silica gel, rather than anhydrous calcium chloride. The film is sealed over 100ml glass jars each containing approximately 20g of preweighed silica gel, and exposed to a saturated

atmosphere of water vapour in air in a desiccator at 20 °C. The rate of water vapour transmission through the film is calculated from the weight gain in the silica gel after 48 hrs exposure.

The edible, moisture-impermeable films of the invention are of value in a variety of applications in the food industry. One such application is in the manufacture of foods which contain both wet and dry domains. Examples of such foods include most bakery, pie-type products (such as quiche lorraine, meat pies, fruit pies and pasties), and also pizzas. A quiche filling may typically have a water activity (Aw) of 0.97 - 0.99, while the pastry base may have a water activity of 0.92 to 0.98. In such products it is common in industry for the filling and pastry to be cooked together in the final product. Such products, therefore, have wet and dry domains in close contact and this can cause problems on storage. Moisture from the wet domain can easily migrate into the dry domain (the pastry), thus wetting it and making it more susceptible to microbial spoilage and at the same time making it organoleptically less acceptable. Such reactions cause a lowering of the viable shelf-life of pies and related products, so that, for example, some superior products of this type may have a chilled shelf-life of only 24 hours. The film of the present invention, providing as it does an effective barrier between the wet and dry domains of mixed food products, considerably enhances the shelf-life of such products.

The protein component of the film of the invention is important because it helps to maintain the integrity of the film during cooking, so that the moisture-barrier properties are retained even after cooking. This is in contrast to the fatty acid/modified cellulose films of the prior art, which are dissipated on cooking, and which are therefore useful as moisture barriers only for uncooked products. Moreover, the films of the invention are extrudable, and have better handling properties (including increased tensile strength

and tear strength) in comparison to such prior art films.

Surprisingly, the films of the invention are generally undetectable (whether visually or organoleptically) in the cooked products. Moreover, the films of the invention are of low cost and are readily handled by machinery.

Other applications of the films of the invention include the formation of pouches which can be used for portion control in the manufacture of pies and similar food products. Of particular advantage in this application is that the films may be heat-sealable.

The edible protein which is used in the film of the invention is preferably insoluble and fibrous, but globular proteins such as casein, albumen and blood proteins may also be used. Examples of suitable fibrous proteins are collagen, keratin and elastin, of which collagen is preferred. The protein may be used in its natural form, or it may be physically or chemically modified prior to use. For example, the fibre length of a fibrous protein may be reduced to less than 0.1mm by physical means such as by forming a fibre gel and then homogenising the gel.

Chemical modification of the protein may include (a) solubilisation by proteolysis (using, for example, pepsin), (b) cross-linking by agents such as aldehydes (e.g. glutaraldehyde or reducing sugars), and aluminium salts, (c) denaturation by heating to induce partial or complete gelatinisation, and (d) hydrolysis with acid or alkali. Two or more such chemical modifications may be used in combination. For example, collagen may be hydrolysed with acid or alkali to form gelatin, and subsequently cross-linked to reduce its solubility during cooking.

When collagen is used as the edible protein, it may suitably be obtained from limed bovine corium, i.e. the inner layer of the skin of male or female cattle, which has

been dehaired and limed using standard commercial procedures. The material may be supplied as whole hide-sized pieces, or may be substituted by any other bovine corium material from any part of the whole hide, e.g. belly "splits", hide off-cuts. Other hide materials can be substituted for this raw material including the hides of any of the domestic meat animals, e.g. pig, sheep, deer, goat, chicken, turkey and other species commonly used for food in various parts of the world e.g. the skin of fish or kangaroo.

The polysaccharide is preferably film-forming and soluble. Examples include charged polysaccharides (e.g. pectin, alginates, agars, carageenans, and chitosan), gums (e.g. arabic, acacia, tragacanth, locust bean and guar), and modified celluloses (e.g. cellulose ethers such as methylcellulose, ethylcellulose, hydroxymethylcellulose, hydroxyethylcellulose, hydroxypropylmethylcellulose, hydroxypropylethylcellulose and carboxymethylcellulose). Starches such as corn flour, crystal gum™, Dry-Flow™, and National Starch B38™ may alternatively be used. The preferred polysaccharide is hydroxypropylmethylcellulose (HPMC).

The hydrophobic material should preferably be tasteless, odourless, solid at room temperatures, and pliable, resisting cracking and flaking when the coated film is manipulated. Suitable hydrophobic materials include edible oils and waxes, such as coconut oil, palm oil, palm kernel oil, acetylated monoglyceride (Dynacet), glycerol monostearate, calcium and sodium steroyl lactate, polyglycerol ester and beeswax. Acetylated monoglyceride is preferred.

The film will generally contain protein in an amount of from 5 to 75%, more preferably from 15 to 35%, and most preferably from 20 to 30% by weight of protein plus polysaccharide. The film may additionally contain

plasticisers, flavourings, colourings and preservatives. The protein content of the uncoated film, including plasticisers and other components, will usually be from 3.5 to 60% by weight, more usually from 12 to 25% by weight, and most preferably from 15 to 22.5% by weight.

Suitable plasticisers include glycerol, sorbitol and polyethylene glycol, in amounts up to 40% by weight of the uncoated film. Preferably, the film contains plasticiser in an amount of from 5 to 30% (and more preferably from 20 to 30%) by weight of the uncoated film.

Flavourings for the film include artificial and naturally occurring flavours, spices and herbs. Suitable colourings include caramel and other permitted artificial or natural food dyes, and are generally employed in amounts less than 5% by weight of the uncoated film. Preservatives, such as propionic acid, sorbic acid, sodium nitrate and sodium nitrite, will usually constitute less than 1% by weight of the uncoated film.

The film may be formed by extrusion from a collagen/polysaccharide gel. The gel preferably has a solids content in the range 2 to 10%, and more preferably in the range 4 to 7%. After extrusion, the gel film is dried by any suitable means, such as by hot air. Preferably, the film is then brought up to a pH of from 6 to 8 by passage through an atmosphere of ammonia.

The hydrophobic material will generally be applied to the film in an amount of from 10 to 50 g/m^2, and more preferably from 20 to 40 g/m^2 of film surface, to produce a coating which is from 10 to 50 micrometers thick. Suitable coating techniques include dipping and brushing, but it is preferred to apply the coating by means of a heated roller or spray.

The films of the invention, and methods for their

manufacture, are now further illustrated by reference to the following example, and to the Figures, in which:

Figure 1 is a graph showing the results of penetrometer studies of the pastry base of a quiche prepared with the film of the present invention, and

Figure 2 is a graph showing the effect of the film of the invention on the moisture content of quiche pastry.

EXAMPLE

1. Washing and decalcification of hides

Limed bovine corium (or other suitable collagen source) is placed in a large rotating vessel, e.g. a stainless steel Challenge-Cooke mixer or any other similar devices for freely mixing the raw material with water and other solvents to aid rapid washing/decalcification. Several deliming agents which remove chemically deposited and chemically bound lime by conversion into readily soluble salts can be utilized, e.g. ammonium sulphate, CO_2 deliming systems, hydrochloric acid, malic acid, acetic acid, lactic acid, citric acid-sodium citrate, or ammonium chloride.

The temperature of the system should be less than 20°C. The procedure is continued until the final liquor pH is approximately 4.5 - 5. The hides are then washed in water and drained. The washed hides may then be stored at 2 -10°C or deep frozen until required. The temperature of all solvents at all stages should be less than 20°C.

2. Grinding

The washed, decalcified and salted raw material is passed through a grinder for initial comminution. The whole pieces of corium are fed continuously into a grinding device such as a Weiler or Wolfking industrial food grinder. The

material is passed through a plate or plates with 5mm-10mm holes such that 100% of the material is comminuted into approximately 5mm-10mm sized pieces of wet grind. The temperature of the material should be minimised at this stage. This wet grind is then transferred immediately to the next stage.

3. Comminution and mixing

The grind is pumped with water directly from the Wolfking or Weiler grinder to a hide and water holding tank. The resulting slurry is further comminuted by passing through Karl Schnell Mincemasters using plate sizes in the range of 1-5mm or through a Stephan Microcut. The temperature rise is minimised at this stage and the resultant collagen pulp stored in the pulp holding tank. Food grade hydrochloric acid, glycerol, sorbitol and optionally aluminium sulphate are then charged to a second holding tank (Acid Tank), together with water and ice. Suitable final concentrations in solution of these components are within indicated ranges:

hydrochloric acid	.075 - 1.0%
glycerol	.5 - 1.0%
sorbitol	4 - 6%
aluminium sulphate	.005 - .01%

The contents of the pulp tank and acid tank are blended together using a Stephan Microcut or similar high shear mixer or a Nauta mixer. The desired gel constituents are obtained and the resultant gel is stored in a blend tank for a minimum of 12 hours.

4. Preparation of collagen/polysaccharide gel

The collagen gel thus obtained from the previous step is mixed in a Giusti pressure/mixing vessel, using iced water for cooling, with a solution of polysaccharide

containing sufficient plasticiser to give a final solids content of 3.5% with a ratio of 25:75 collagen:polysaccharide by weight and the same final percentage of plasticiser as in the collagen only gel. Suitable polysaccharides include guar gum, locust bean gum, National Starch B38, crystal gum, "Dry-Flow", corn flour, methyl cellulose and hydroxypropyl methyl cellulose (HPMC), preferably HPMC.

The resulting gel is homogenised using a Cherry Burrell homogeniser with automatic pressure control (34.5 ± 1.4 MPa, ie 5000 ± 200psi, with a minimal temperature rise) and passed into a line tank at a minimum of -730mm Hg via a deaerating distributor. The tank is pressurised to 270 kPa (2.7 Bar) and the gel then passed through two gel filters. Four filter banks are used to allow changing of gel filters - 2 for the first filter (placed in parallel) and 2 for the second filter (placed in parallel). The first and second filters should be placed in series, and the gel filters should be capable of retaining particles greater than 0.076mm (0.003").

5. Extrusion

The gel is transferred directly to an extruder. For extrusion, the gel is maintained at a maximum temperature of 19 ± 4°C) and extruded at 345 kPa (50 psi) onto a suitable conveyor, such as a PTFE (polytetrafluorethylene) coated glass fibre belt. The film is then batch-dried on the conveyor at 45°C for approximately 20 mins.

6. Hydrophobic coating

A hydrophobic layer is applied to one surface of the film using a heated roller loaded with the coating material, producing an even coating approximately 12.5 micrometres (0.0005") thick. Materials tested were: coconut oil, beeswax, palm oil, palm kernel oil, acetylated monoglyceride

(Dynacet), glycerol monostearate, calcium and sodium steroyl lactate and polyglycerol ester.

7. Cooking Trials

(i) Quiches

Quiches were prepared in 200 mm or 140 mm diameter aluminium moulds

Pastry ingredients:	% w/w
Flour, soft plain white	58.7
Margarine	29.3
Water, chilled	11.7
Salt	0.3

Half the flour and all the margarine was blended in a food processor to form a smooth paste. The salt was dissolved in the water and creamed into the mixture. The other half of the flour was added and the mixture processed to a homogeneous ball of pastry. 250g or 120g of pastry was rolled by hand to 4mm thick and pressed into the mould and trimmed. The base of the pastry was pricked to prevent expansion of air bubbles distorting the pastry during cooking.

Filling ingredients:	% w/w
Milk, skimmed	74.8
Eggs, whole	24.9
Salt	0.3

The milk was heated to 50°C and the eggs and salt beaten in. 330g or 200g (for smaller quiches) of filling was added to the raw pastry base. In the experimental quiches, the pastry base was first covered with the film of the invention, with the hydrophobic surface uppermost. The

(ii) Meat Pies

Pastry was made to the recipe described above, and 1400mm diameter aluminium moulds were lined with 4mm thick rolled pastry. 200g of commercial tinned meat filling in gravy was added directly to the pastry shell or retained within an experimental film pouch prior to placing in the shell. A top crust (80g of pastry) was placed on top of the pie. Pies were baked at 175°C for 35-40 minutes, allowed to cool to room temperature, then chilled to 5°C.

8. Assessments

(i) Shrinkage

Any shrinkage of the film was detected visually on separation of the filling from the pastry base.

(ii) Penetrometer Studies

A characteristic of the pastry base which varies with moisture content is the resistance to deformation under applied pressure. This was measured in 50mm discs cut out of the pastry after removal of the filling, using a Lloyd tensile tester, type 5002, with an 8mm diameter probe attached to a 100 Newton load cell, crosshead speed 25mm per min. The characteristic of the stress/strain curve which was used was the peak height (Fig. 1), corresponding to "firmness" or resistance to penetration; this was expressed as Newtons (N).

into film pouches, using a heated metal bar, prior to placing in the pie case.

(iii) Shrinkage on Cooking

Collagen film with no polysaccharide component shrank during cooking in quiches, exposing the pastry base and allowing penetration of moisture from the filling. However, inclusion of polysaccharide in the collagen film

(iii) Moisture Content

The filling was separated from the pastry base and both were ground to homogeneity. 10g samples were weighed before and after heating at 80°C to constant weight (6h for pastry, 20h for filling). 5 replicate samples were taken from each pie or quiche.

(iv) Sensory Assessment

A standard triangle taste for sensory difference was used with a randomly selected panel of 24 tasters. Samples of quiches were allocated random codes and the mode of presentation was balanced. Identification of one film-containing sample from two control samples was evaluated using the BS 5929, Part 1 (1980) test.

9. Results

(i) Film Production

No problems were encountered with the production of collagen/polysaccharide films; all those produced had sufficient mechanical strength and flexibility for handling.

(ii) Heat-sealing of Film

It was found possible to seal portions of pre-filling into film pouches, using a heated metal bar, prior to placing in the pie case.

(iii) Shrinkage on Cooking

Collagen film with no polysaccharide component shrank during cooking in quiches, exposing the pastry base and allowing penetration of moisture from the filling. However, inclusion of polysaccharide in the collagen film

substantially reduced this thermal shrinkage: Methocel showed no detectable shrinkage during cooking in quiches.

(iv) Water Migration in Quiches

Examination of the pastry base typically showed three layers:

1. Closest to the filling was an opaque, white, soft, greasy layer.

2. A central layer which was white, dry and "crumbly" with small visible air spaces.

3. An outer layer, in contact with the cooking container, which was pale brown, dry and crumbly.

(a) Moisture Content

The migration of moisture from filling into the pastry base increased with time, illustrated by the change in water activity (Table 1). This change was confirmed by measurement of moisture content (Figure 2, upper curve).

Incorporation of the film of the invention into quiches significantly reduced the rate of moisture migration into the pastry, determined by moisture content. The results of comparative tests involving the use of films coated with different hydrophobic materials are set out in Table 2. The best results were obtained with acetylated monoglyceride as the hydrophobic material. Not only was this most effective in reducing water migration, but it also had the best characteristics for application, adherence, flexibility, taste and mouthfeel, and it was therefore used for all subsequent tests.

A further series of comparative tests showed that a film comprising hydroxypropylmethylcellulose as the

polysaccharide component was more effective as a moisture barrier than similar films containing alternative polysaccharides (Table 3). HPMC was therefore used as the polysaccharide component in subsequent tests.

Figure 2 (lower curve) illustrates the reduced rate of water migration into the pastry base of a quiche in which the filling and the pastry base are separated by a film comprising collagen and HPMC, with a coating of acetylated monoglyceride.

(b) Pastry Crispness

The load/deformation characteristics of the pastry base measured on a tensile tester are shown in Figure 1. The three regions of the curve, A, B and C, are thought to correspond to the three layers of the cooked pastry, described above. The mean rupture load of the pastry decreased during storage, but the decrease was significantly less in quiches incorporating the film when compared with controls (Table 4).

(c) Taste Panel Assessments

The hedonic scores from a taste panel showed a clear improvement in "crispness" of the pastry in quiches with film (Table 5). The scores indicate consistently higher "brittleness" and lower "softness" for the film-containing samples.

(v) Detectability of the Film

A taste panel assessment showed that a non-neutralised collagen film was detectable in quiches - due to its texture and "bitter" taste. However, a collagen/Methocel/Dynacet film which was neutralised after extrusion using ammonia was not detected by a significant proportion of tasters (10/24 compared with an expected 8/24 in the BS 5929 Part 1

The moisture content of the base crust in control pies rose by 5.1% between 24 and 48h, whereas the moisture content of pies containing film rose only 0.7% (Table 6). The top crusts, however, showed a similar rise in water content in control and film-containing pies.

(b) Load/Deformation Properties

The rupture-load of the top and base crusts were measured 24 and 48h after cooking. The pies containing film showed a significantly lower rupture load then controls in the top crusts at both 24 and 48h, but a higher rupture load for the base crust (Table 7).

It will be appreciated that the present invention has been described above by way of example only, and that many variations are possible within the scope of the appendant claims.

Coconut oil	28
Palm kernel oil	29

CLAIMS

1. A film comprising an edible protein and an edible polysaccharide, said film having a coating of an edible hydrophobic material on at least a portion of a surface thereof.

2. A film according to claim 1 wherein said edible protein is a fibrous protein or a modified fibrous protein.

3. A film according to claim 2, wherein the fibrous protein is collagen.

4. A film according to any preceding claim, wherein the polysaccharide is selected from charged polysaccharides, gums and modified celluloses.

5. A film according to claim 4 wherein the polysaccharide is hydroxypropylmethylcellulose.

6. A film according to any preceding claim, wherein the hydrophobic material is an edible oil or wax.

7. A film according to claim 6 wherein the hydrophobic material is an esterified glyceride.

8. A film according to claim 7 wherein the esterified glyceride is acetylated monoglyceride.

9. A film according to any preceding claim wherein the film comprises from 3.5 to 60% protein, from 3.5 to 60% polysaccharide, and from 0 to 40% plasticiser, said percentages being by weight of the uncoated film.

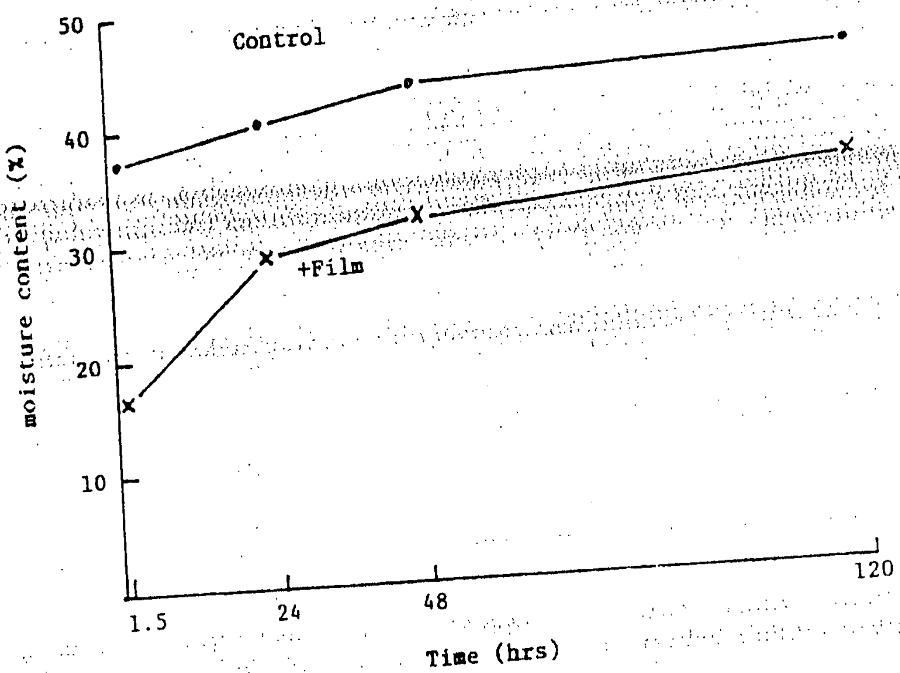
10. A film according to any preceding claim wherein the hydrophobic material is present in an amount of from 10 to 50 g/m^2.

of lower moisture content comprises pastry.

SUBSTITUTE SHEET

2/28/05 EAST Version: 2.0.1.4

Fig 2: The Effect of Barrier Film on the Moisture Content of Quiche Pastry



III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
Y	WO,A,8 600 501 (WISCONSIN ALUMNI RESEARCH FOUNDATION) 30 January 1986 see claims 1-16,42 see page 3, line 25 - page 6, line 10 see page 7, line 19 - page 8, line 6 see page 8, line 28 - page 9, line 20	1-12
Y	WORLD PATENTS INDEX Derwent Publications Ltd., London, GB; AN 78-16712A(09) & JP,A,53 005 270 (SUMITOMO BAKELITE) 18 January 1978 see abstract	1-12

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° Special categories of cited documents :[10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
23 OCTOBER 1991	07. 11. 91
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	VUILLAMY V.M.L.

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Form PCT/ISA/210 (second sheet) (January 1985)

Form PCT/ISA/210 (extra sheet) (January 1985)

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PAT-NO: JP356137871A

DOCUMENT-IDENTIFIER: JP 56137871 A

TITLE: PREPARATION OF **EDIBLE FILM** CONSISTING OF FISH MEAT **PROTEIN** ESSENTIALLY

PUBN-DATE: October 28, 1981

INVENTOR-INFORMATION:

NAME	**COUNTRY**
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NAME	**COUNTRY**
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APPL-NO: JP55040805

APPL-DATE: March 28, 1980

INT-CL (IPC): A23L001/325

ABSTRACT:

PURPOSE: To prepare an **edible film** having a high strength and improved flavor, by flattening a salt ground fish meat mixed with common salt under heating, and drying the flattened fish meat.

CONSTITUTION: A ground fish meat or a fish meat containing much salt-solution **proteins,** e.g. a tuna or bonito, is ground with salt, kneaded with a starch, vegetable **protein,** glucide, or various flavoring raw material, seasoning, etc. and then flattened under heating at a temperature of 50□120°C and a pressure of 10kg/cm2 or below to give a proteinic **film of thickness** 0.05□2mm, which is then dried to a moisture content ≤40% with infrared rays, etc.

⑲ 日本国特許庁（JP）　⑪特許出願公開
⑫ 公開特許公報（A）　昭56—137871

㊿Int. Cl.³	識別記号	庁内整理番号
A 23 L 1/325	101	6971—4B

㊸公開 昭和56年(1981)10月28日

発明の数 1
審査請求 未請求

（全 2 頁）

㊹魚肉蛋白を主体とする食用フィルムの製造方法

㉑特　　願　昭55—40805
㉒出　　願　昭55(1980)3月28日

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明　　細　　書

1　発明の名称

魚肉蛋白を主体とする食用フイルムの製造方法

2　特許請求の範囲

本文に詳記する様に、魚のすり身、あるいはマグロ、カツオ等の塩溶性蛋白を多く有する魚肉を塩摺りし、これに物性を安定させる為に、でん粉、植物性蛋白、糖質、風味原料、調味料を加えて練り上げたものを50℃～120℃、10㎏/㎠以下で、加熱圧扁し、0.05㎜～2㎜厚のフイルム状蛋白素材を作る事を特徴とする蛋白フイルムの製造方法。

3　発明の詳細な説明

従来、オブラード、麺類等から作った食用フイルムは世にあったが、これに風味原料を混入し薄くして、フイルム強度を強く保つ事が難かしかった。

本発明は、魚肉に食塩を加え塩摺りしたものを、50℃～120℃で平板又はロールに依り加熱プレスし更に水分を40％以下に乾燥する事に依り強度の強い蛋白フイルムを見出した。

この事から更に強度を増す事と、風味、味を付ける為に、でん粉、植物性蛋白、糖質かつお節粉、エビ粉、のり、調味料等を加えて、それぞれ風味の優れた食用フイルムを得た。

かつお節、エビ、しそ等の風味原料の多くはフイルム化された事がなく、利用範囲も限られていた。

本発明は上記材料等そのまゝではフイルム化されないものを、フイルム化する事が可能であり又、空気に触れて酸化し易い風味原料であっても、表面をフイルム質が皮膜としてガードし、長期間風味を保たせ得る事が特徴の1つである。

以下に風味原料単体とフイルム化品との比較を示す。

比較品＼経過日数	5日	10日	15日	30日	90日
かつお節削り節	+++	+	±	=	=
かつお節入りフィルム	++	++	++	++	+
エビ粉	+++	++	+	+	±
エビ粉入りフィルム	+++	+++	+++	+++	++

＋：香りの強さ

4　この発明の実施の1例

助宗すり身1000gを、塩摺りし、これに小麦グルテン30g、小麦粉30g、糖質50g、かつお節粉100g、調味料20g、水100gを加えて練り上げる。

(1)　練り上ったもの20gを0.1㎜厚程度のアルミ板に乗せ、上から同じくアルミ板で蓋をする。この1組を平らに設置された加熱プレスで両面から95℃ 5秒間1㎏/㎠でプレスすると、約0.2㎡、0.1㎜厚のフィルムとなった。

その後片面のアルミ板をはずし、乾燥器内で赤外線乾燥し水分18.5％のフィルム10gを得た。

(2)　練り上ったものをシートベルト、コンベアー上に一定速度で流す。

上部にもシート・ベルトコンベアーを設け、上部シートと下部シートで間隔を調節され、厚さを決定する。両シートで、厚さを決定された原料は下部シートベルトの下に設けられたヒーター板とその真上に設けられた、上部シート外側にある熱ロールでシート外部から加熱しフィルムを作る。下部シートベルトは上部シートベルトに比べ長いので、フィルムは下部シートに乗って、連続で流れる。その後連続して乾燥する。

ロール及ヒーター温度	105℃
原料加熱温度	93℃
ベルト巾	30㎝
シートベルト速度	1.6m/分
フィルム厚さ	0.1㎜

次にこの発明品の用途を示す

1) 厚さ0.05㎜～0.1㎜（水分15％～18％）	：菓子等の風味付け巻用、切りのり状味付け品、細かく切ってふりかけ
2) 0.2㎜～1.0㎜（水分10％～50％）	：寿し用フィルム菓子、珍味シユーマイ、ワンタンの皮
3) 1.0㎜～2.0㎜（水分10％～60％）	：細く切って魚ソーメン、珍味シート、天プラ素材

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29

Technology of Packaging Under Film

C. Behra, J. Guerin

29.1 Introduction

The study of under film packaging technology, in particular, that covering equipment for bagging, shows that in spite of the apparently vast variety of designs, there is in fact only a limited number of basic machines. Moreover, the different machines carry out fairly similar unitary operations.

We have classified the machines according to the way in which the packagings are shaped.

29.2 Overpackaging Machines

An overpackaging machine can be used either for grouping together previously packaged individual items, in which case the film forms a transportation packaging, or to provide mechanical protection for individual products during transportation, storage, and marketing.

The packaging materials used are usually cellulose, polypropylene, polyethylene and paper, or compounds derived from these films.

There is also the range of stretch films, where the film, usually PVC (polyvinyl chloride), overwraps products placed on polystyrene trays.

The products for packaging must have a well-defined shape.

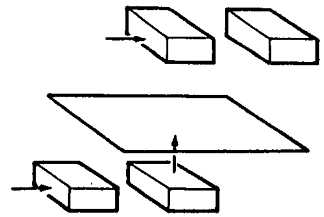

Figure 29.1. "Pushing upward" principle on overpackaging machines—first step.

Overpackaging machines can be subdivided into four groups:

- "pushing upward"
- "pushing downward"
- "pushing through"
- "pushing in"

29.2.1 Pushing Upward

On the overpackaging machines which operate according to this principle, the product for packaging is positioned under the packaging material by a feed system and then lifted up against this material (Figure 29.1). As the product is pushed up it becomes wrapped in the film which has been previously cut (Figure 29.2).

The flaps are then folded against the packet by folding elements and the lengthwise seal is along the bottom of the packet.

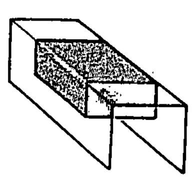

Figure 29.2. "Pushing upward"—second step.

29.2.2 Pushing Downward

In this case, the product is brought above the material to be pushed down onto it (Figure 29.3). The lengthwise closing fold is along the top of the packet. With both the earlier principles, the products for packaging are brought one by one either above or below the packaging film which is supplied from a roll fixed below the machine. The product is then pushed into the material by a raising or lowering mechanism. At the moment when the product is positioned between the folding elements, the packaging film is cut from the roll by a special knife, then stretched around the product in order to make it look attractive.

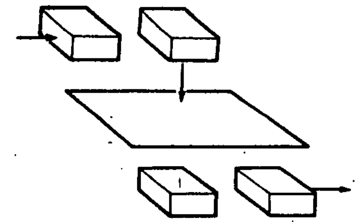

Figure 29.3. "Pushing downward" principle on overpackaging machines.

The folding device is double: one is fixed and the other mobile.

After this operation, the wrapped product is sent to a folding track to fold the side overlaps. Packaging is completed by sticking or sealing (Figure 29.4).

When a package remains closed due to the nonelasticity of its material, it is called *dead fold.* This property is essential for products that must be kept in an oxygen-free environment for their preservation.

29.1.3 Pushing Through

The principles just described are applicable. The difference is in the feed system which remains in the same horizontal plane from the beginning to the end of the operation. This may have a good effect on output rates and therefore on production (Figure 29.5). Moreover, in this case, the fold, which never

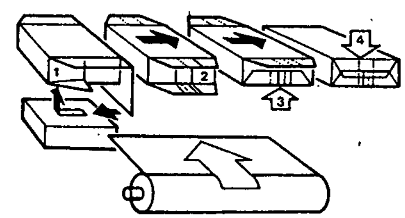

Figure 29.4. Representation of the overpackaging machine operation ("pushing upward and downward").

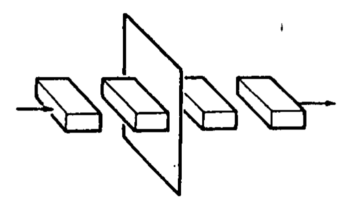

Figure 29.5. "Pushing through" principle on overpackaging machines.

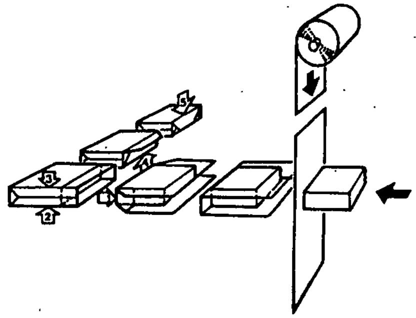

Figure 29.6. Flow diagram of a "pushing through" overpackaging machine. The packaging has a 90° angle.

enhances the appearance, will be on the side of the packet, which is an improvement (Figure 29.6).

29.2.4 Pushing In

These are usually the fastest machines and often work on small products (toffees, sweets, cigarette packets, etc.).

The product to be packaged is fed horizontally or vertically between two guiding planes so that the film is formed in a U for wrapping (see Figure 29.7).

This type of machine is sometimes fitted with twisting tongs which complete the closure of the packaging by twisting the ends (Figure 29.8).

29.3 Form, Fill, and Seal (FFS) Machines

Bags made from soft plastic, whether transparent or not, have gained an important place in the packaging of foods, whether fresh, frozen, cooked, pasteurized, or sterilized, to be used as they are, or for reheating.

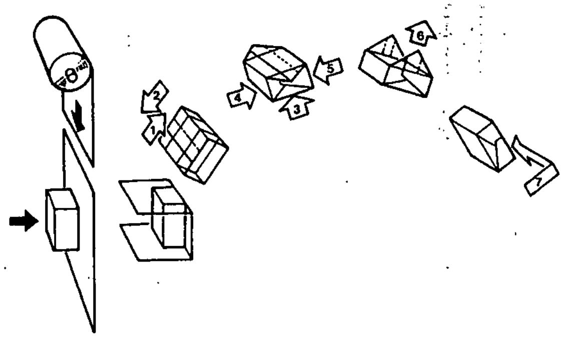

Figure 29.7. Flow diagram of an overpackaging machine for small articles ("push in" principle).

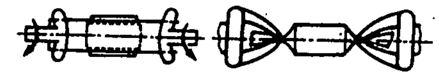

Figure 29.8. Twist closure.

The development of these composite flexible barrier materials, obtained by counter-sticking, lamination, or coextrusion, has been simultaneous with the development of physical conservation techniques.

The machines on which all the operations of forming, filling, and sealing the bags are carried out, have also been developing rapidly.

29.3.1 The Bags

The bags can be classified into three categories:

- cushion shaped ("pillow pouches")
- three-weld pouches
- four-weld pouches

The first two categories form the major part of unitary portion pouches. Four-weld pouches can be used either for unit pouches or a string of multiportion pouches.

29.3.1.1 Pillow Pouches

Pillow pouches have a lengthwise weld which joins the end of the packaging film to make a tube. This weld can be done in two ways:

- "Fin seal" or folded edge sealing. A film tag is welded onto itself and flattened along the length of the packet (Figure 29.9). The weld is made by means of a thermal bar or by pushing onto the welding surface.
- "Lap seal" or overlap seal: A band of film is welded by covering the inner layer of one end by the outer layer of the other end (Figure 29.10).

Lap sealing is usually stronger but demands a greater width of film.

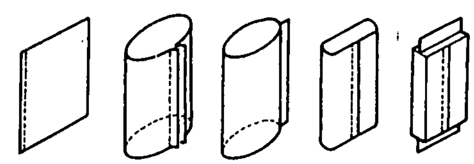

Figure 29.9. Pillow pouches — fin seal.

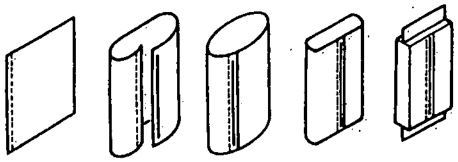

Figure 29.10. Pillow pouches — lap seal.

29.3.1.2 Three-weld Pouches

Three-weld pouches are obtained by folding the film lengthwise in its ... with or without a gusset (Figure 29.11). This folding is done by a triang... conformer, or tubular shaping shoulder.

The fold forms a closure of the pouch generally at the base. It can be wel... to reinforce its sealing properties. The three other sides are usually heat se... along the ends (fin seal) and thus form highly resistant closures.

29.3.1.3 Four-weld Pouches

Four-weld pouches demand the use of two identical or different films ... precut shapes are welded on their four sides.

29.3.2 The Materials

The materials usually come in the shape of rolls, either plain or printed ... flexography or photoengraving.

29.3.2.1 Sizes

The sizes must be adapted to the dimensions and type of final packet as ... as to the dimensions and type of FFS machines.

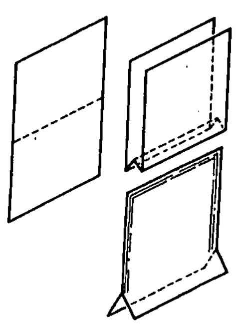

Figure 29.11. Three-weld pouch with a gusset at the base.

...typical range of width of these FFS machines is between 200 and ...m diameter of conformator tube.

...typical dimensions of pouches range from 10–15 mm length for chain ...aging with four-sided pouches up to 600 or 800 mm length containing as ...as 10–15 kg of powdered product.

...2.2 Structures/Composition

...materials are usually of a complex structure. The composition of these ...pound materials will depend on the product to be packaged, its distribu... ...cycle, shelf life, and packaging output rates.

...characteristics of machinability are determined by the flatness of the ...al, its sliding properties, and its weldability (low welding temperature ...wide welding range).

...substratum may have a paper, aluminum, or polyester base, be ...inized film or bioriented polypropylene.

...welding agent will be made from polyethylene, polyethylene copolymers ...as EVA, ionomeric resins, linear polyethylenes or copolymers, and ...ypropylene.

...ese will be selected according to the resistance required for the final seals ...ending on the temperature of use), the production rates and the ranges of ...erature for welding, but also the sealing properties in the presence of ...ous or oily liquid contaminants or powdered solids.

...barrier properties will be provided by a PVDC layer (polydichloride of ...idene) or of EVOH (polyvinylic alcohol) "sandwich extruded" or by ...er varnishes, vinylic, acrylic, or other.

...conservation related to the use of barrier properties of the films may be ...longed by injecting neutral or inert gas into the pouch (usually carbon ...oxide [CO_2] or nitrogen [N_2]). In this case, the seals must be gas proof.

...3.3 The Machines

...machines may be classified according to the manner in which they are fed ...the packaging material. We can make a distinction between:

- ...reel of film, vertically or horizontally flat
- ...reel of film folded lengthwise, vertical or horizontal
- ...o reels of film held vertically or horizontally flat
- ...tubular film

...terms *vertical* or *horizontal* indicate the principal direction of flow of the ...during the fabrication of the pouch.

...3.3.1 Fill, Form, and Seal Machines Using a Flat Film Reel

...packaging film is fed from a reel from which it is formed, filled, and sealed ...ssively at top and bottom.

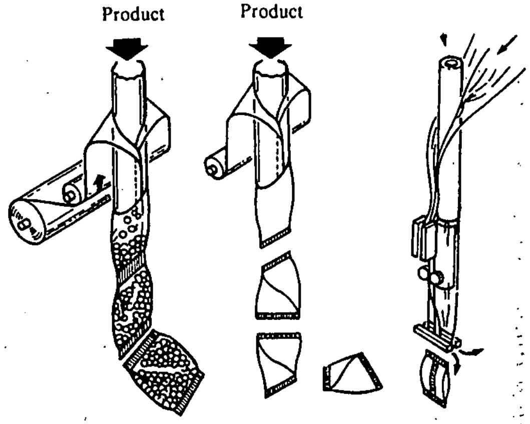

Figure 29.12. Diagram of a vertical FFS machine (using a flat film reel).

29.3.3.1.1 Vertical Machines (Figure 29.12)

The material unwinds from the wheel and is conveyed by various guiding rollers onto a forming shoulder. The film wound around the feed pipe of the product forms a tube whose lengthwise fold is sealed.

After sealing the lower crosswise fold of the package, the product to be packaged is introduced into the pouch by its feed system and the upper crosswise fold is sealed. Usually, the upper crosswise fold is sealed simultaneously with that at the base of the following pouch. A cutting mechanism is integrated in the crosswise sealing unit. The pouches are carried away either by gravity or by a conveyer belt.

29.3.3.1.2 Horizontal Machines (Figure 29.13)

Horizontal machines are similar to vertical machines. The difference resides in the fact that the product must be fed before the film arrives below the forming element.

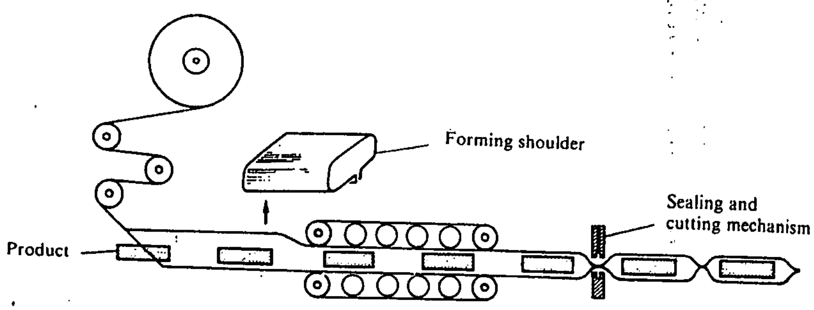

Figure 29.13. Flow diagram of a horizontal FFS machine (using a reel of flat film).

29.3.3.2 *Form, Fill, and Seal Machines Using a Reel of Film Folded Lengthwise*

The pouch produced by these machines is rectangular and has three welds. The machine is fed either by folded film or by a flat film folded on a triangle placed downstream from the unwinding unit. There is no difference between vertical or horizontal machines except for their operating direction (Figure 29.14).

29.3.3.3 *Form, Fill, and Seal Machines Using Two Flat Reels*

These machines produce four-weld pouches (Figure 29.15). They too are divided into vertical or horizontal machines according to the flow direction of the film.

Usually powdered products or small products in batches are fed by gravity on a vertical machine, whereas horizontal machines are used for more bulky and calibrated unitary products.

The forward flow of the film is provided either by longitudinal seam welders or by crosswise seal jaws.

29.3.3.4 *Form, Fill, and Seal Machines Using Tubular Film*

These machines are used for packaging liquids in pouches. The pouch is formed without a lengthwise fold. The tubular film unwinds, is cut at the required length and sealed at one end. The pouches shaped in this way are fed onto a filling turntable where they are filled with the product and sealed. The

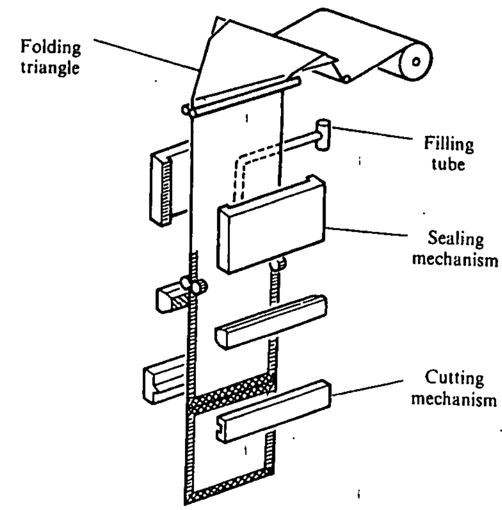

Figure 29.14. Flow diagram of a vertical machine (folded film).

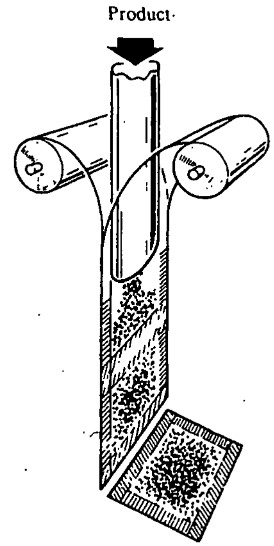

Figure 29.15. Flow diagram of a vertical machine (two flat film reels).

pouches, held by suction grips during the filling operation, are dropped and carried away by a conveyer belt or by gravity (Figure 29.16).

29.4 Heat-Forming Machines

In the widest sense of the term, heat forming consists of giving a thermoplastic material the required shape by heating it. This technique makes it possible to place the plastic film in contact with the object to be packaged or a mold. The material is heated to the point where it becomes shapeable. The action of the mold (negative shaping) or of the punch (positive shaping) is completed and facilitated by air pressure or a void suction, or again by a shrinking effect. On cooling, the thermoplastic film will solidify and form a pocket of the required dimensions.

29.4.1 The Materials

The films used can be stiff or soft.

- The stiff materials are usually coextruded polyvinyl chloride, polystyrene, polypropylene, or polyethylene, polyester, terephthalate-based compounds. The structure will be completed by a binding agent and a sandwich barrier layer.
- Among the soft materials, there are also compound films, usually of a polyamide or PET-base forming underlayer.

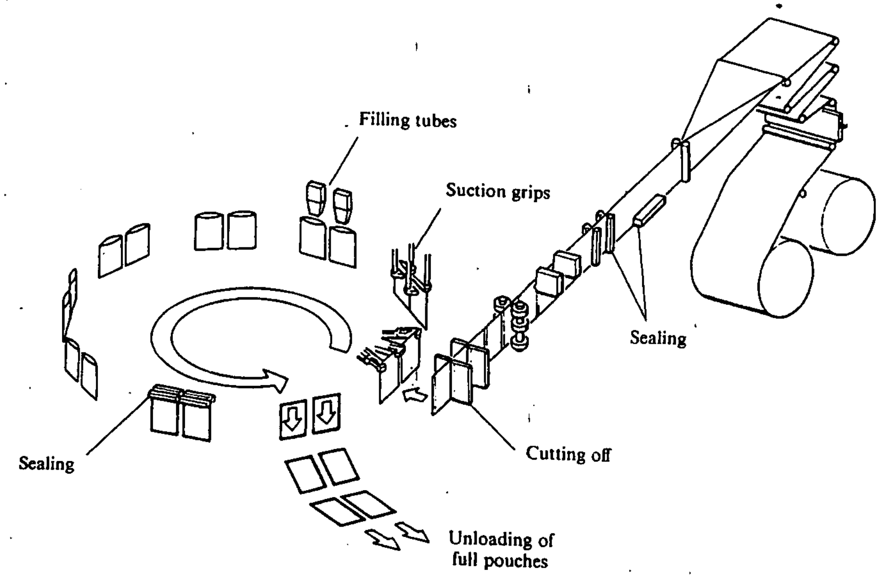

Figure 29.16. Form, fill, and seal machines for tubular film.

29.4.2 The Machines

Heat-forming machines can be classified according to the type of packaging they produce. We distinguish:

- one- or two-bobbin shrinkable film envelopes
- drawing machines: form, fill, and seal machines
- skin pack machines

29.4.2.1 Shrink Film "Bundle" Wrapping Machines

Shrink-on packaging material used on these machines will have been previously "oriented" (macromolecular chain structures have been stretched). When this film is heated, it shrinks in the direction of its orientation. This process is used both for unit packaging and for assembling items, either prepacked or not.

The film is fed from one or two reels and the product for packaging is placed on the film or between the two films. The overpackaged product is conveyed toward the sealing unit for sealing.

The sealing bars are L or U shaped (Figure 29.17).

After sealing, the package is conveyed toward the shrinking tunnel. Under the effect of heat in the tunnel, the material tightens around the product to form a protective wrap which holds it very firmly.

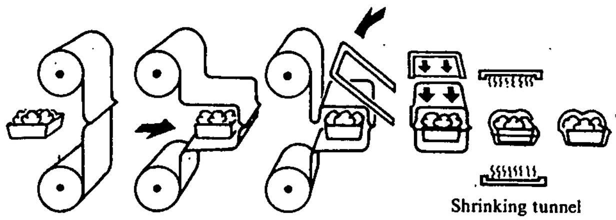

Figure 29.17. Flow diagram of shrink film wrapping machines (two-reel type).

A balanced bioriented material will shrink evenly in both directions. A reticulated bioriented material will shrink so much that it will "hug" all the contours of the product to be packaged (second skin effect).

29.4.2.2 Shaping Machines

Shaping machines can be classified according to the type of packaging they produce.

- machines for forming stiff or semistiff pockets
- machines for closing or covering the stiff or semistiff pockets with a single or multilayer film
- form, fill, and seal machines (Figure 29.18).

As previously mentioned, the pocket is obtained by a combination of mechanical distortion (mold/stamp) with void and/or compressed air. The shaping material is unwound and preheated prior to being conveyed to the molding station. After being formed, the pocket is filled and covered with a second film.

Usually a void is created or a neutral gas mixture is injected in order to prolong shelf life. For fresh delicate products such as milk-based desserts it is even possible to have aseptic packaging. The packet is then sealed and severed. Waste particles are evacuated.

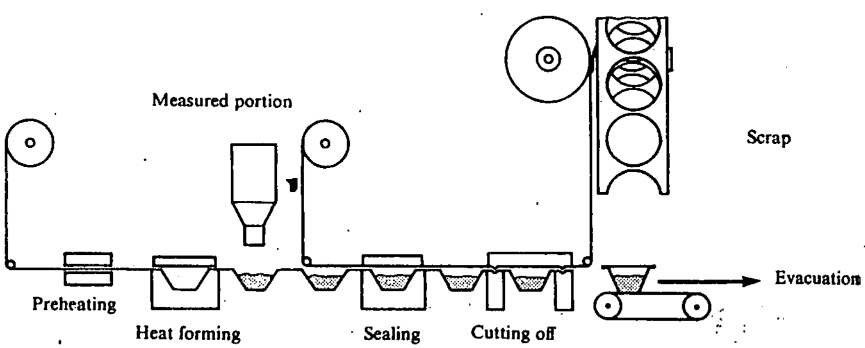

Figure 29.18. Flow diagram of shaping machines.

29.4.2.3 Skin Pack Machines

Skin pack indicates that the packaging material clings around the product like a second skin, thus improving the appearance, the protection, and conservation. From this point of view, it has an edge over heat forming by the shaping machine.

Moreover, it is better than the heat-shrinking process inasmuch as the film covers the product to be packaged without crushing or squeezing it. Thus, in the field of foodstuffs, it provides a third generation packaging for all fragile and exudative products.

There are two types of skin packaging:

- Nonfoodstuffs skin packaging in which the void serves solely to shape the hot plastic film around the product to be packaged and not to empty the packaging of any residual oxygen for purposes of conservation. In this case, the lower film is a coated, porous cardboard, forming the top of a vacuum chamber. The heated plastic film is draped over the product to be packaged and is sealed onto the coated cardboard.

Usually this type of packaging is perforated at the end, in order to be hang displayed.

- Skin packaging for the food industry uses the vacuum both for shaping and to empty the pocket of residual oxygen (Figure 29.19).

The lower film is a soft or semistiff material either transparent or dyed in the mass. The upper film is a multilayer material. Both materials provide high barrier properties and as the packet obtained is very attractive, it is changing the approach to the packaging of fresh meat, cured products, and individual portions of meat for distribution in supermarkets.

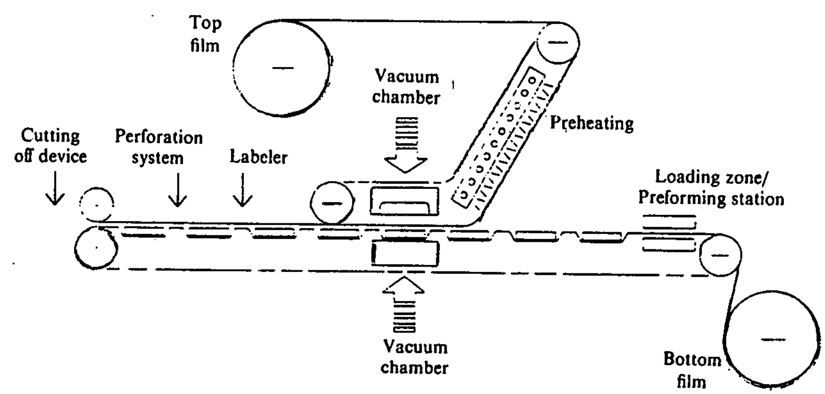

Figure 29.19. Flow diagram of a foodstuffs skin packaging machine.

29.5 Typical Applications in the Food Industry

Packaging processes under film mean optimizing three elements: the machine, the film, and the product.

In addition to the role of information, presentation and protection, these processes will have to provide the best conservation, that is, the product will keep its original qualities. This conservation depends on exterior factors (storage temperature, heat treatments, ionizers, etc.), but also on the gaseous environment in which the product will be kept.

29.5.1 Certain Products Such as Bread Need Films Having High Steam Permeability

Present day solutions include using perforated films or, more recently, microperforated films in order to prevent the crust from becoming soggy due to excess moisture. The density of the perforation is studied, depending on the type of bread and on its shelf life (white bread, brown bread, etc.).

Films used today are shrinkable polypropylenes with the help of horizontal FFS machines or L-shaped sealing machines.

29.5.2 Prepared Vegetables

The wide range of prepared vegetables is known as the fourth range (green salad, grated carrots, cabbage, etc.) due to a respiratory exchange of these gases. After preparation, films with a fairly high permeability to oxygen, carbon dioxide, and steam are required.

The role of the film is to maintain, inside the packaging, an atmosphere enriched with carbon dioxide, poor in oxygen and which allows water vapor to escape.

The difficulty resides in the fact that there must be a minimum exchange with the outside environment so that the product is not stifled, and as respiration differs from one product to another, each type of vegetable will, theoretically, demand a specific film.

In fact, certain compromises have been found and OPP films exist alongside reticulated PEs (the first are more suitable for green salads and the second for other vegetables). These films are utilized on vertical FFSs.

An interesting application for reticulaled polyethylenes is to package citrus fruit individually. The selective permeabilities of these films make it possible to considerably improve the shelf life of these products by allowing them to be stored at ambient temperature and thus considerably reducing chemical surface treatments.

29.5.3 Fresh Meat

Fresh meats, particularly beef, must be bright red at the time of their sale to the consumer in the supermarket. In this case, constant oxygenation must be provided in order to keep the meat pigment in the form of oxymyoglobin. For short shelf lives, highly permeable films are therefore used, notably stretch PVC with packaging in expanded polystyrene trays by "pushing through" wrapping machines.

29.5.4 Oxygen Sensitivity

Certain foodstuffs are sensitive to the oxygen contained in the air either because they contain oxidizable elements (e.g., fats) or because their bacterial flora contains putrefying aerobic microorganisms (e.g., *Pseudomonas*), whose proliferation generates a rapid alteration of the product. Consequently, vacuum packaging is used.

29.5.4.1 Industrial Portions

Industrial portions of meat and cured products are vacuum packed in multilayer shrinkable sacks using so called "Bell" machines (the sack is sealed using welding or stapling).

In addition to their gas barrier properties, these materials, due to their shrinkability, have the advantage of considerably reducing the exudate which appears during conservation.

Bacteriological studies (Fournaud et al., 1973) showed that there is an evolution of the microbial flora, due to the absence of oxygen, toward lactic bacteria which proliferate at the expense of putrefying aerobic bacteria; thus muscles are conserved for more than 4 weeks at 0 + 2°C.

29.5.4.2 Individual Portions

Individual consumer portions of pork products are also vacuum packed but standardization has made it possible to use heat-forming machines, and more recently, skin-type machines. The first makes use of multilayer materials with a polyamide and polyethylene base. The second, more technical materials (coextrusion) whose principal characteristics are high formability and high gas barrier properties ($<5\,cc/m^2$ per 24 h to oxygen). The skin techniques thus provide a better conservation of the product.

29.5.4.3 Fragility

Use of modified atmosphere may be justified when the product is too fragile for placing in a vacuum (e.g., pork pies) or, because the gas injected into the packaging provides specific advantages for the product (overoxygenation of beef for maintaining the oxymyoglobin or use of carbon dioxide to improve shelf life).

Packaging of Dutch cheese slices, for example, is done using PA/PE multilayers on horizontal FFS with carbon dioxide gas sweep. The gas dissolves gradually in the water contained in the cheese so that it looks very similar to that conserved under vacuum.

29.5.5 Packaging Evolution

Film packaging is gradually evolving toward more specific permeabilities, toward constant improvement of presentation and, finally, toward automation made possible by standardized production.

CHAPTER

30

Cleaning and Disinfecting Reusable Packaging

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In a previous chapter, we mentioned that according to the stipulations of articles 10 and 11 of the decree dated 12 February 1973, materials coming into contact with foodstuffs must be clean and their cleansing must be carried out only with substances authorized for this purpose.

The question of cleanliness and the means of obtaining it is particularly important in the case of reuse of packaging, as during and after the first utilization, packaging elements run the risk of becoming soiled. It is therefore essential to systematically verify their cleanliness.

30.1 Reusable Packaging

30.1.1 Definition of Reusable Packaging

What is reusable packaging? Packaging is usually designed for a specific use. If it is only used once, it is said to be a single-use package. If it can be reused, because it is suitable for another usage, and if the regulations allow this, then it is a reusable package. The reusable package may be returnable.

From 1950–1973, there was considerable development in single-use packaging. Then, the energy crisis and pollution of the environment encouraged reflection and action against waste and nuisances. In fact, it is possible in certain sectors to recover waste (paper, metal, glass, plastic, etc.) and to recycle them to make new packaging materials. It is also possible to recover packages which can be used several times.